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ABSTRACT

This exploration of co structivism begins with a discussion of constructivist epistemology and lea ing theory, explaining that constructivist epistemology is difficu t to label, though many writers, educators, and researchers have come t o an agreement about how this constructivist epistemology should af ect educational practice and learning. The paper goes on to consider what c nstructivism means for learning, offering a summary of characteristic of constructivist learning and teaching and using the summary to compile a c nstructivist checklist. This checklist can be applied by educators to educ tional projects and environments in order to observe the way in which constr ctivist epistemology and theories of learning can be accommodated in ed cational practice. The paper concludes by suggesting that an important chal enge for educational reform is to begin to question and come to greater unde standing of the philosophy, theory, and epistemology that presently info ns educational practice. (Contains 32 references.) (SM)

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Constructivism: From Philosophy to Practice

Elizabeth Murphy

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Socrates liked to work with students. His approach essentially consisted of leading them through a series of questions in order to promote critical thinking. On one occasion, the philosopher purportedly led a group of students to a difficult conclusion through his Socratic method. Socrates then pointed out that, since he had reported no facts, the students must have known the conclusion all along.

Socrates is not generally associated with constructivist philosophy. Nonetheless, this anecdote highlights the fact that discussions which link epistemology and learning have been taking place for thousands of years. From the perspective of psychology, epistemology considers the genesis and the nature of knowledge and includes learning (Ernest, 1995). Knowledge, its nature and how we come to know, are essential considerations for constructivists. Von Glasersfeld describes constructivism as a "theory of knowledge with roots in philosophy, psychology and cybernetics" (p.162). In the constructivist perspective, knowledge is constructed by the individual through his interactions with his environment.

How we perceive knowledge and the process of coming to know provides the basis for educational practice. If we believe that learners passively receive information then priority in instruction will be on knowledge transmission. If, on the other hand, we believe that learners actively construct knowledge in their attempts to make sense of their world, then learning will likely emphasize the development of meaning and understanding. Constructivists generally claim that knowledge is not discovered and that the ideas teachers teach do not correspond to an objective reality.

While the preceding paragraphs provide a seemingly simple explanation of constructivism and its relation to educational practice, the following pages will illustrate that the link between the philosophy, on one hand, and educational practice, on the other, is quite tenuous. Moving from theory to practice always presents challenges, be it in education or in any other domain. When there are multiple brands of the theory, the task becomes that much more demanding.

Although there are those who will argue that constructivism does not provide a model for implementation, numerous researchers, educators and authors are actively engaged in using constructivist principles to design and implement new learning environments. Technology is increasingly being touted as an optimal medium for the application of constructivist principles to learning. Numerous online environments and technology-based projects are showing that theory can effectively guide educational practice.

This exploration of constructivism begins with a discussion of constructivist epistemology and learning theory. Following this discussion, a summary of characteristics of constructivist learning and teaching will be presented The summary of characteristics will be used to compile a constructivist checklist. The checklist can be applied by educators to educational projects and environments in order to observe the way in which constructivist epistemology and theories of learning can be accommodated in educational practice.

Socrates is now online. That is to say that there are various World Wide Web sites that feature his discussions and lectures as reported by Plato. Ironically, his approach led to his downfall since the

SP039420

self-doubt that individuals experienced after conversing with him finally led the Athenian assembly to vote to put him to death. Today, Socrates is not only widely quoted and well known, but his questioning approach is often hailed as an effective teaching technique. Were he present today, he would likely show an interest in constructivism, no doubt recognizing in it some similarities with his own philosophy.

CONSTRUCTIVIST EPISTEMOLOGY

How do we come to know what we know? What is knowledge? What is truth? What is reality? These are important questions not only for epistemologists or philosophers who study knowledge, but, as well for those interested in science, language, values, educational psychology, and even for computer programmers developing artificial intelligence systems. Whether we see knowledge as absolute, separate from the knower and corresponding to a knowable, external reality or whether we see it as part of the knower and relative to the individual's experiences with his environment has far-reaching implications.

Wilson (1997) in his description of the evolution of world views noted that, in ancient times, people believed that only God could provide glimpses of the 'real' world. Mathematics and logic had an important role to play in making this knowledge manifest. During the Renaissance, the scientific method evolved as the perceived method of uncovering 'the truth'. The German philosopher Kant later denied this possibility of arriving at a precise grasp of absolute knowledge. Still, the modern view trusted in the ability of science to reveal 'the world'. Postmodernists, argues Wilson, preferred to reject "the idealized view of truth inherited from the ancients and replace it with a dynamic, changing truth bounded by time, space and perspective" (p.2).

Thus, in the history of epistemology, the trend has been to move from a static, passive view of knowledge towards a more adaptive and active view (Heylighen, 1993). Early theories emphasized knowledge as being the awareness of objects that exist independent of any subject. According to this objectivist view, objects have intrinsic meaning, and knowledge is a reflection of a correspondence to reality. In this tradition, knowledge should represent a real world that is thought of as existing, separate and independent of the knower; and this knowledge should be considered true only if it correctly reflects that independent world. Jonassen (1991) provides a summary of objectivism:

> *Knowledge is stable because the essential properties of objects are knowable and relatively unchanging. The important metaphysical assumption of objectivism is that the world is real, it is structured, and that structure can be modelled for the learner. Objectivism holds that the purpose of the mind is to "mirror" that reality and its structure through thought processes that are analyzable and decomposable. The meaning that is produced by these thought processes is external to the understander, and it is determined by the structure of the real world.* (p.28)

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In contrast, the constructivist view argues that knowledge and reality do not have an objective or absolute value or, at the least, that we have no way of knowing this reality. Von Glasersfeld (1995) indicates in relation to the concept of reality: "It is made up of the network of things and relationships that we rely on in our living, and on which, we believe, others rely on, too" (p.7). The knower interprets and constructs a reality based on his experiences and interactions with his environment. Rather than thinking of truth in terms of a match to reality, von Glasersfeld focuses instead on the notion of viability: "To the constructivist, concepts, models, theories, and so on are viable if they prove adequate in the contexts in which they were created" (p.7).

On an epistemological continuum, objectivisim and constructivism would represent opposite extremes. Various types of constructivism have emerged. We can distinguish between radical, social, physical, evolutionary, postmodern constructivism, social constructionism, information-processing constructivism and cybernetic systems to name but some types more commonly referred to (Steffe & Gale, 1995; Prawat, 1996; Heylighen, 1993). Ernest (1995) points out that "there are as many varieties of constructivism as there are researchers" (p.459). Psychologist Ernst von Glasersfeld whose thinking has been profoundly influenced by the theories of Piaget, is typically associated with radical constructivism - radical "because it breaks with convention and develops a theory of knowledge in which knowledge does not reflect an objective, ontological reality but exclusively an ordering and organization of a world constituted by our experience" (von Glasersfeld, 1984, p.24). Von Glasersfeld defines radical constructivism according to the conceptions of knowledge. He sees knowledge as being actively received either through the senses or by way of communication. It is actively constructed by the cognizing subject. Cognition is adaptive and allows one to organize the experiential world, not to discover an objective reality (von Glasersfeld, 1989).

In contrast to von Glaserfled's position of radical constructivism, for many, social constructivism has emerged as a more palatable form of the philosophy. Heylighen (1993) explains that social constructivism "sees consensus between different subjects as the ultimate criterion to judge knowledge. 'Truth' or 'reality' will be accorded only to those constructions on which most people of a social group agree" (p.2). So, while the differences between objectivism and constructivism can be clearly delineated, such is not the case for the differences between the varying perspectives on constructivism. Derry (1992) points out that constructivism has been claimed by "various epistemological camps" that do not consider each another "theoretical comrades". There is considerable debate amongst philosophers, researchers and psychologists about which brand of constructivism is....what should we say? About which brand...is true? right? viable? corresponds to reality?

Constructivist epistemology is obviously difficult to label. Depending on who you are reading, you may get a somewhat different interpretation. Nonetheless, many writers, educators and researchers appear to have come to an agreement about how this constructivist epistemology should affect educational practice and learning. The following section considers what constructivism means for learning. It is an important consideration if we take into account the large and increasing volume of literature and numerous discussions about this new theory of learning. For many, constructivism holds the promise of a remedy for an ailing school system and provides a robust, coherent and convincing alternative to existing paradigms.

CONSTRUCTIVIST LEARNING THEORY

Agreement on a constructivist theory of learning is not widespread due largely to what Derry (1996) terms "ethnocentrism within various constructivisms". At the same time, Ernest (1995) notes that, of seven paradigms of constructivism, the positions are all variants of radical constructivism. The outstanding consideration, however, concerns the need as Ernst sees it: "to accommodate the complementarity between individual construction and social interaction" (p.483). Whether knowledge is seen as socially situated or whether it is considered to be an individual construction has implications for the ways in which learning is conceptualized. From the radical constructivist perspective, how can their theory encompass both the collective activity and the individual experience to take into account the important classroom social interactions that are so much a part of the entire educational process?

Such questions underlie the complexities involved in translating the diversity of perspectives into a common set of principles that can be operationalised. Yet, as Ernest claims in relation to the varying constructivist perspectives: "there is the risk of wasting time by worrying over the minutiae of differences" (p.459). Perhaps then, the optimal starting point for understanding the constructivist perspective to teaching and learning is to consider what constructivism is not.

Constructivism is often articulated in stark contrast to the behaviorist model of learning. Behaviorial psychology is interested in the study of changes in manifest behavior as opposed to changes in mental states. Learning is conceived as a process of changing or conditioning observable behavior as result of selective reinforcement of an individual's response to events (stimuli) that occur in the environment. The mind is seen as an empty vessel, a tabula rasa to be filled or as a mirror reflecting reality. Behaviorism centers on students' efforts to accumulate knowledge of the natural world and on teachers' efforts to transmit it. It therefore relies on a transmission, instructionist approach which is largely passive, teacher-directed and controlled. In some contexts, the term behaviorism is used synonymously with objectivism because of its reliance on an objectivist epistemology. Jonassen (1991) describes the assumptions of an objectivist approach to learning:

> Objectivists believe in the existence of reliable knowledge about the world. As learners, the goal is to gain this knowledge; as educators, to transmit it. Objectivism further assumes that learners gain the same understanding from what is transmitted (...) Learning therefore consists of assimilating that objective reality. The role of education is to help students learn about the real world. The goal of designers or teachers is to interpret events for them. Learners are told about the world and are expected to replicate its content and structure in their thinking. (p.28)

This objectivist model has resulted in somewhat of a stereotyped portrayal of teaching and learning which is a widely criticized and often evoked as the target of educational reform. Susan Hanley, in an online discussion of constructivism, describes her perspective on the objectivist model:

> Classes are usually driven by "teacher-talk" and depend heavily on textbooks for the structure of the course. There is the idea that there is a fixed world of knowledge that the student must come to know. Information is divided into parts and built into a whole concept. Teachers serve as pipelines and seek to transfer their thoughts and meanings to the passive student. There is little room for student-initiated questions, independent thought or interaction between students. The goal of the learner is to regurgitate the accepted explanation or methodology expostulated by the teacher. (p.3)

Where behaviorism emphasizes observable, external behaviours and, as such, avoids reference to meaning, representation and thought, constructivism takes a more cognitive approach. This subtle difference has profound implications for all aspects of a theory of learning. The way in which knowledge is conceived and acquired, the types of knowledge, skills and activities emphasized, the role of the learner and the teacher, how goals are established: all of these factors are articulated differently in the constructivist perspective. Within constructivism itself, authors, researchers and theorists articulate differently the constructivist perspective by emphasizing different components.

Nonetheless, there is some agreement on a large number of issues, for example, on the role of the teacher and learner. In von Glasersfeld's (1995b) radical constructivist conception of learning, the teachers play the role of a "midwife in the birth of understanding" as opposed to being "mechanics of knowledge transfer". Their role is not to dispense knowledge but to provide students with opportunities and incentives to build it up (von Glasersfeld, 1996). Mayer (1996) describes teachers as "guides", and learners as "sense makers". In Gergen's (1995) view, teachers are coordinators, facilitators, resource advisors, tutors or coaches. Understanding the role of the teacher in the constructivist classroom provides a useful vantage point from which to grasp how the theory impacts on practice:

> The role of the authority figure has two important components. The first is to introduce new ideas or cultural tools where necessary and to provide the support and guidance for students to make sense of these for themselves. The other is to listen and diagnose the ways in which the instructional activities are being interpreted to inform further action. Teaching from this perspective is also a learning process for the teacher (Driver, Aasoko, Leach, Mortimer, Scott, 1994, p. 11).

While the radical and social perspectives of constructivism each have their particular emphases, Ernest derives a set of theoretical underpinnings common to both:

1. Knowledge as a whole is problematized, not just the learner's subjective knowledge, including mathematical knowledge and logic.

2. Methodological approaches are required to be much more circumspect and reflexive because there is no "royal road" to truth or near truth.

3. The focus of concern is not just the learner's cognitions, but the learner's cognitions, beliefs, and conceptions of knowledge.

4. The focus of concern with the teacher and in teacher education is not just with the teacher's knowledge of subject matter and diagnostic skills, but with the teacher's belief, conceptions, and personal theories about subject matter, teaching, and learning.

5. Although we can tentatively come to know the knowledge of others by interpreting their language and actions through our own conceptual constructs, the others have realities that are independent of ours. Indeed, it is the realities of others along with our own realities that we strive to understand, but we can never take any of these realities as fixed.

6. An awareness of the social construction of knowledge suggests a pedagogical emphasis on discussion, collaboration, negotiation, and shared meanings... (p.485).

Central to constructivism is its conception of learning. Von Glasersfeld (1995) argues that: "From the constructivist perspective, learning is not a stimulus-response phenomenon. It requires self-regulation and the building of conceptual structures through reflection and abstraction" (p.14). Fosnot (1996) adds that "Rather than behaviours or skills as the goal of instruction, concept development and deep understanding are the foci... (p.10). For educators, the challenge is to be able to build a hypothetical model of the conceptual worlds of students since these worlds could be very different from what is intended by the educator (von Glasersfeld, 1996).

In this paradigm, learning emphasizes the process and not the product. How one arrives at a particular answer, and not the retrieval of an 'objectively true solution', is what is important. Learning is a process of constructing meaningful representations, of making sense of one's experiential world. In this process, students' errors are seen in a positive light and as a means of gaining insight into how they are organizing their experiential world. The notion of doing something 'right' or 'correctly' isto do something that fits with "an order one has established oneself" (von Glasersfeld, 1987, p. 15). This perspective is consistent with the constructivist tendency to privilege multiple truths, representations, perspectives and realities. The concept of multiplicity has important implications for teaching and learning.

> ...mathematics and science are viewed as systems with models that describe how the world might be rather than how it is. These models derive their validity not from their

> accuracy in describing the world, but from the accuracy of any predictions which might be based on them (Hanley, 1994, p.4).

Multiplicity is an overriding concept for constructivism. It defines, not only the epistemological and theoretical perspective but, as well, the many ways in which the theory itself can be articulated. Researchers and theorists have developed variants of constructivism or have evolved the theory in different directions. Nonetheless, there are many common themes in the literature on constructivism which permit the derivation of principles, instructional models and general characteristics. The following section outlines how a constructivist epistemology and theory of learning may be expressed as or translated into a wide variety of specific characteristics or principles of constructivist learning and teaching.

CHARACTERISTICS OF CONSTRUCTIVIST LEARNING & TEACHING

Moving from constructivist philosophy, psychology and epistemology to the characterization of constructivist learning environments presents the challenge of synthesizing a large spectrum of somewhat disparate concepts. An appropriate analogy for the way in which constructivist concepts have evolved is that of a prism with many facets. While the facets reflect the same light and form one part of a whole, they nonetheless each present distinct and finely delineated boundaries.

The presentation of characteristics in this section aims to remain true to this analogy in that it recognizes and attempts to represent the variety of ways in which constructivism is articulated in the literature. Situated cognition, anchored instruction, apprenticeship learning, problem-based learning, generative learning, constructionism, exploratory learning: these approaches to learning are grounded in and derived from constructivist epistemology. Each approach articulates the way in which the concepts are operationalized for learning. The researchers and theorists whose perspectives are listed below suggest links between constructivist theory and practice. They provide the beginnings of an orienting framework for a constructivist approach to design, teaching or learning.

Jonassen (1991) notes that many educators and cognitive psychologists have applied constructivism to the development of learning environments. From these applications, he has isolated a number of design principles.

1. Create real-world environments that employ the context in which learning is relevant;

2. Focus on realistic approaches to solving real-world problems;

3. The instructor is a coach and analyzer of the strategies used to solve these problems;

4. Stress conceptual interrelatedness, providing multiple representations or perspectives on the content;

5. Instructional goals and objectives should be negotiated and not imposed;

6. Evaluation should serve as a self-analysis tool;

7. Provide tools and environments that help learners interpret the multiple perspectives of the world;

8. Learning should be internally controlled and mediated by the learner. (pp.11-12)

Jonassen (1994) summarizes what he refers to as "the implications of constructivism for instructional design". The following principles illustrate how knowledge construction can be facilitated:

1. Provide multiple representations of reality;
2. Represent the natural complexity of the real world;
3. Focus on knowledge construction, not reproduction;
4. Present authentic tasks (contextualizing rather than abstracting instruction);
5. Provide real-world, case-based learning environments, rather than pre-determined instructional sequences;
6. Foster reflective practice;
7. Enable context-and content dependent knowledge construction;
8. Support collaborative construction of knowledge through social negotiation. (p.35)

Wilson and Cole (1991) provide a description of cognitive teaching models which "embody" constructivist concepts. From these descriptions, we can isolate some concepts central to constructivist design, teaching and learning:

1. Embed learning in a rich authentic problem-solving environment;
2. Provide for authentic versus academic contexts for learning;
3. Provide for learner control;
4. Use errors as a mechanism to provide feedback on learners' understanding. (pp.59-61)

Paul Ernest (1995) in his description of the many schools of thought of constructivism suggests the following implications of constructivism which derive from both the radical and social perspectives:

1. sensitivity toward and attentiveness to the learner's previous constructions;
2. diagnostic teaching attempting to remedy learner errors and misconceptions;
3. attention to metacognition and strategic self-regulation by learners;
4. the use of multiple representations of mathematical concepts;

5. awareness of the importance of goals for the learner, and the dichotomy between learner and teacher goals;
6. awareness of the importance of social contexts, such as the difference between folk or street mathematics and school mathematics (and an attempt to exploit the former for the latter). (p.485)

Honebein (1996) describes seven goals for the design of constructivist learning environments:

1. Provide experience with the knowledge construction process;
2. Provide experience in and appreciation for multiple perspectives;
3. Embed learning in realistic and relevant contexts;
4. Encourage ownership and voice in the learning process;
5. Embed learning in social experience;
6. Encourage the use of multiple modes of representation;
7. Encourage self-awareness in the knowledge construction process. (p.11).

An important concept for social constructivists is that of scaffolding which is a process of guiding the learner from what is presently known to what is to be known. According to Vygotsky (1978), students' problem solving skills fall into three categories:

1. skills which the student cannot perform
2. skills which the student may be able to perform
3. skills that the student can perform with help

Scaffolding allows students to perform tasks that would normally be slightly beyond their ability without that assistance and guidance from the teacher. Appropriate teacher support can allow students to function at the cutting edge of their individual development. Scaffolding is therefore an important characteristic of constructivist learning and teaching.

Multiple perspectives, authentic activities, real-world environments these are just some of the themes that are frequently associated with constructivist learning and teaching. There were many similarities between the perspectives of different researchers in this brief review of the literature. The following section presents a synthesis and summary of the characteristics of constructivist learning and teaching as presented by the above review and as suggested by the previous section on constructivist theory. These are not presented in a hierarchical order.

1. Multiple perspectives and representations of concepts and content are presented and encouraged.

2. Goals and objectives are derived by the student or in negotiation with the teacher or system.

3. Teachers serve in the role of guides, monitors, coaches, tutors and

facilitators.

4. Activities, opportunities, tools and environments are provided to encourage metacognition, self-analysis -regulation, -reflection & -awareness.

5. The student plays a central role in mediating and controlling learning.

6. Learning situations, environments, skills, content and tasks are relevant, realistic, authentic and represent the natural complexities of the 'real world'.

7. Primary sources of data are used in order to ensure authenticity and real-world complexity.

8. Knowledge construction and not reproduction is emphasized.

9. This construction takes place in individual contexts and through social negotiation, collaboration and experience.

10. The learner's previous knowledge constructions, beliefs and attitudes are considered in the knowledge construction process.

11. Problem-solving, higher-order thinking skills and deep understanding are emphasized.

12. Errors provide the opportunity for insight into students' previous knowledge constructions.

13. Exploration is a favoured approach in order to encourage students to seek knowledge independently and to manage the pursuit of their goals.

14. Learners are provided with the opportunity for apprenticeship learning in which there is an increasing complexity of tasks, skills and knowledge acquisition.

15. Knowledge complexity is reflected in an emphasis on conceptual interrelatedness and interdisciplinary learning.

16. Collaborative and cooperative learning are favoured in order to expose the learner to alternative viewpoints.

17. Scaffolding is facilitated to help students perform just beyond the

limits of their ability.

18. Assessment is authentic and interwoven with teaching.

CONSTRUCTIVIST CHECKLIST

Constructivism is a theory of knowledge with roots in philosophy, psychology and cybernetics. Such is the definition provided by constructivist's leading theorist, E. von Glasersfeld (1989). How does this theory of knowledge translate into practice? How do definitions of what it means to "construct knowledge" inform our actions as educators? While constructivism is clearly gaining popularity as a new paradigm for learning, many question how the philosophy can be operationalized. They argue that it does not provide a method, approach or particular pedagogy.

At the same time, numerous researchers and educators are busy designing what they refer to as constructivist learning environments. Descriptions abound of what their creators refer to as "constructivist" projects, activities and approaches. How have these projects realized the transition from constructivist philosophy to practice? What characteristics do these projects and environments exhibit? The previous section presented a summary of constructivist characteristics. This section considers how these characteristics might be exhibited in a given learning environment or project.

The following checklist is designed to serve as a simple instrument to observe some of the ways in which these constructivist characteristics might be present in learning projects, activities and environments. The observation should provide insights into the ways in which constructivist philosophy translates into practice. The checklist can be applied to projects, activities and learning environments which are presented online or which educators are now using in their classrooms. It should provide educators with some insights into how constructivist concepts might be operationalized in an instructional setting.

CONSTRUCTIVIST CHECKLIST

CHARACTERISTIC	SUPPORTED	NOT SUPPORTED	NOT OBSERVED
Multiple perspectives			
Student-directed goals			
Teachers as coaches			
Metacognition			
Learner control			
Authentic activities & contexts			

Knowledge construction			
Knowledge collaboration			
Previous knowledge constructions			
Problem solving			
Consideration of errors			
Exploration			
Apprenticeship learning			
Conceptual interrelatedness			
Alternative viewpoints			
Scaffolding			
Authentic assessment			
Primary sources of data			

SUMMARY

In Molière's Bourgeois Gentilhomme, the 'nouveau riche' Jourdain, who wants nothing more than to be accepted into the company of the French Aristocracy, makes an important discovery: "I am speaking prose! I have always spoken prose! I have spoken prose throughout my whole life!". Jourdain's sudden realization highlights the notion that not all our actions are necessarily directly guided by an overt knowledge of the reasoning behind them. In the same way, educators often adopt a particular approach or method without necessarily having purposely considered the theory or philosophy that underpins the approach. Intuition, successful experiences, observations: these factors play an important role in influencing the behaviour of teachers and, no doubt, often dictate their practice.

The fact that practice can relate to theory but not be directly or knowingly guided by it is evidence of the complexity of the relationship between the two. It is likely that the more general the theory, the more easily it may translate either directly or indirectly into practice. In this sense, constructivism lends itself well to practice. It has been interpreted, refashioned and reformulated into at least seven different forms. Combinations of these forms such as radical and social are inspired by or relate to the writings and theories of Vygotsky, Piaget, von Glasersfeld, Varela, Wittgenstein, and Bateson to mention but a few. Constructivism thus provides a broad base for interpretation and for practice.

Can constructivism effectively translate into a learning theory from an epistemology, and from a learning theory to practice? Application of the checklist can provide educators with a tool to compare the variety of ways in which constructivism could be both interpreted and translated into practice.

No doubt there are many projects, sites and activities that are inspired by a constructivist philosophy either directly or indirectly. No doubt there are many teachers who, without knowing of the term, without having been informed of the theory, without following a prescriptive design, are providing the students in their care with opportunities for constructivist learning. As von Glasersfeld (1995) comments:

> Contructivism does not claim to have made earth-shaking inventions in the area of education; it merely claims to provide a solid conceptual basis for some of the things that, until now, inspired teachers had to do without theoretical foundation.

Von Glasersfeld's musings remind us that theory and practice exhibit a curious interplay which is ofttimes unpredictable and, sometimes, unexplainable. His comments remind us as well that constructivism is more than a theory of learning. It is a way of looking at the world that is broad enough to allow for multiple interpretations and yet, defined sufficiently to allow for a perspective that can explain complex and abstract phenomenon and which can guide our actions. We tend to take for granted and accept unquestioningly the use of terms such as 'true', 'real', 'worlds'. Consideration of the complexities behind these everyday words seems far removed from the daily practice of the classroom and more like the fodder of philosophers such as...Socrates.

Constructivism reminds us that these are not only important philosophical notions. On the contrary, they can significantly affect how we see the world and, more importantly, how we behave in it. Perhaps an important challenge for educational reform is to begin to question and come to a greater understanding of the philosophy, theory and epistemology that presently informs educational practice. Like Molière's Jourdain, understanding what our behaviours and practices mean can ofttimes be both revealing, and, hopefully, useful.

REFERENCES

Atzori, P. (1996). Discovering CyberAntarctic: A Conversation with Knowbotics Research. CTHEORY. Available at: http://www.ctheory.com/

Brown, J.S., Collins, A. & Duguid, S. (1989). Situated cognition and the culture of learning. Educational Researcher, 18(1), 32-42.

Derry, S. (1992). Beyond symbolic processing: Expanding horizons in educational psychology. Journal of Educational Psychology, 413-418.

Derry, S. (1996). Cognitive Schema Theory in the Constructivist Debate. In Educational Psychologist, 31(3/4), 163-174.

Driver, R., Aasoko, H., Leach, J., Mortimer, E., Scott, P. (1994). Constructing scientific knowledge in the classroom. Educational Researcher, 23 (7), 5-12.

Ernest, P. (1995). The one and the many. In L. Steffe & J. Gale (Eds.) Constructivism in education (pp.459-486). New Jersey: Lawrence Erlbaum Associates,Inc.

Fosnot, C. (1996). Constructivism: A Psychological theory of learning. In C. Fosnot (Ed.) Constructivism: Theory, perspectives, and practice, (pp.8-33). New York: Teachers College Press.

Gergen, K. (1995). Social construction and the educational process. In L. Steffe & J. Gale (Eds.). Constructivism in education, (pp.17-39). New Jersey: Lawrence Erlbaum Associates,Inc.

Hanley, Susan (1994). On Constructivism. Available at: http://www.inform.umd.edu/UMS+State/UMD-Projects/MCTP/Essays/Constructivism.txt

Honebein, P. (1996). Seven goals for the design of Constructivist learning environments. In B. Wilson, Constructivist learning environments, pp. 17-24. New Jersey: Educational Technology Publications.

Heylighen, F. (1993). Epistemology, introduction. Principia Cybernetica Available at: http://pespmc1.vub.ac.be/EPISTEMI.html

Hogan, K. & Pressley, M. (Eds). (1997). Scaffolding Student Learning : Instructional Approaches and Issues (Advances in Learning & Teaching). MA: Brookline Books.

Jonassen, D. (1991, September). Evaluating Constructivist Learning. Educational Technology, 36(9), 28-33.

Jonassen, D. (1994, April). Thinking technology. Educational Technology, 34(4), 34-37.

Jonassen, D. (1991). Objectivism vs. Constructivism. Educational Technology Research and Development, 39(3), 5-14.

Mayer, R. (1996). Learners as information processors: Legacies and limitations of educational psychology's second metaphor. In Educational Psychologist, 31(3/4), 151-161.

Mendelsohn, P. & Dillenbourg, P. (1994). Implementing a model of cognitive development in an intelligent learning environment. In S. Vosniadou, E. De Corte, & H. Mandl, (Eds.) Technology-based learning environments: Psychological and educational foundations, (pp.72-78). Berlin: Springer-Verlag.

Perkins, D. (1992) Technology meets constructivism: Do they make a marriage. In

T. Duffy & D. Jonassen, Constructivism and the technology of instruction: A conversation.(pp.45-56). New Jersey: Lawrence Erlbaum Associates, Publishers.

Prawat,R. (1996). Constructivisms, modern and postmodern. In Educational Psychology, 31(3/4),215-225.

Resnick, L. & Collins, A. (1996). Cognition and learning. In T. Plomp & D. Ely, (Eds.) The International Encyclopedia of Educational Technology, 2nd ed. (pp.48-54). Oxford: Pergamon Press.

Steffe, L. & Gale, J. (Eds.) (1995). Constructivism in education. New Jersey: Lawrence Erlbaum Associates,Inc.

von Glasersfeld, E. (1984). An introduction to radical constructivism. In P. Watzlawick, The Invented Reality, (pp.17-40). New York: W.W. Norton & Company.

von Glasersfeld, E. (1987). Learning as a constructive activity. In C. Janvier, Problems of representation in the teaching and learning of mathematics, (pp.3-17). New Jersey: Lawrence Erlbaum Associates, Inc.

von Glasersfeld, E. (1989). Constructivism in education. In T. Husen & N. Postlewaite (Eds.), International Encyclopedia of Education [Suppl.], (pp.162-163). Oxford, England: Pergamon Press.

von Glasersfeld, E. (1995). A constructivist approach to teaching. In L. Steffe & J. Gale (Eds.). (1995). Constructivism in education, (pp.3-16). New Jersey: Lawrence Erlbaum Associates, Inc.

von Glasersfeld, E. (1995b). Sensory experience, abstraction, and teaching. In L. Steffe & J. Gale (Eds.). Constructivism in education, (pp.369-384). New Jersey: Lawrence Erlbaum Associates,Inc.

von Glasersfeld, E. (1996) Introduction: Aspects of constructivism. In C. Fosnot (Ed.), Constructivism: Theory, perspectives, and practice, (pp.3-7). New York: Teachers College Press.

Vygotsky, L. (1978). Mind in Society: The Development of Higher Psychological Processes MA: Harvard University Press.

Wilson, B. & Cole, P. (1991) A review of cognitive teaching models. Educational Technology Research and Development, 39(4), 47-64.

Wilson, B. (1997). The postmodern paradigm. In C. R. Dills and A. Romiszowski (Eds.), Instructional development paradigms. Englewood Cliffs NJ: Educational

Technology Publications. Also available at
http://www.cudenver.edu/~bwilson/postmodern.html